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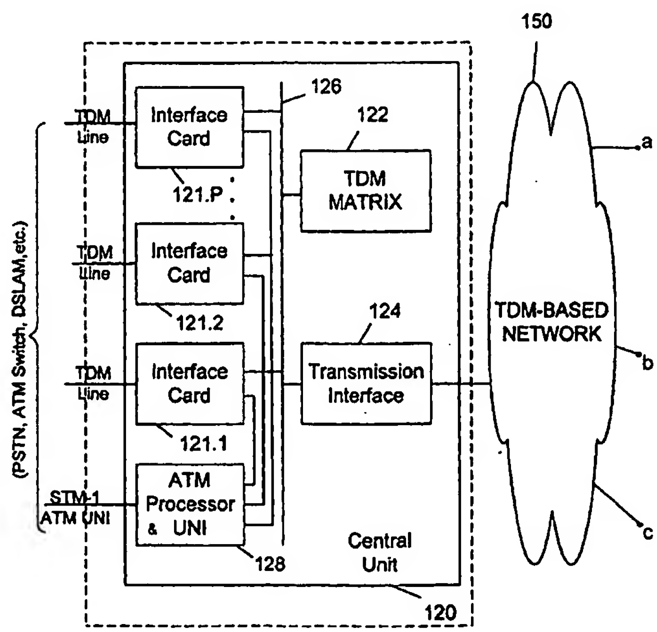

(57) Abstract: An integrated asymmetric digital subscriber line interface card with time division multiplex mapping is provided. The asymmetric digital subscriber line interface card includes an asymmetric digital subscriber line interface device and a translation device coupled to the asymmetric digital subscriber line interface device. Additionally, the asymmetric digital subscriber line interface card includes an inverse multiplexer coupled to the asymmetric digital subscriber line interface device and a time division multiplex interface coupled to the inverse multiplexer.

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INTEGRATED ADSL INTERFACE WITH TDM MAPPING

TECHNICAL FIELD

The present invention relates generally to telecommunications, and in particular, to providing an ADSL interface using TDM mapping.

BACKGROUND

Telecommunication systems originally designed for voice services at a relatively slow speed have rapidly changed to carry data at high speeds. Prior to the 1960s, the telephone system used primarily analog switches and other analog equipment. With the increasing capability of computer systems and other digital electronics, the telephone system began to include digital switches and other equipment. Digital Loop Carriers (DLCs) were developed to allow connections from a number of subscribers to be routed to a location remote from the central office and then connected to the central office over a high speed, digital line.

Transporting data has posed a variety of problems for conventional telephone systems. The low bandwidth channels to carry voice traffic that the telephone system was designed with can provide a significant obstacle to providing higher bandwidth data services that have become so popular, e.g. the Internet and other data networks. Additionally, the adaptation of the telephone system for high bandwidth data services has become an expensive enterprise.

Digital Subscriber Line (DSL) is a generic name for a family of evolving digital services to be provided by local telephone companies to their local subscribers. DSL includes but is not limited to Single Pair Symmetrical Services (SDSL), Asymmetric Digital Subscriber Line (ADSL), High Bit Rate Digital subscriber line (HDSL) and Very-high-data-rate Digital Subscriber Line (VDSL). These services provide high-speed connections over existing copper wires to carry conventional telephone traffic. These services use various modulation schemes and other techniques to allow the data to be transmitted over the existing copper lines at higher speeds. In addition to data, some of these DSL technologies allow multiple phone lines to share one physical line thus increasing the capacity of the system without the need to install additional copper connections between the customer and the network.

Unfortunately, DSL voice traffic is not directly compatible with conventional equipment in the Public Switched Telephone Network (PSTN). For example, DSL voice traffic conventionally is incorporated in Asynchronous Transfer Mode (ATM) packets or cells. ATM is a cell-based technology that supports voice, video, and data over a wide range of transmission speeds. The biggest benefit of ATM is its ability to optimize wide-area bandwidth while accommodating the characteristics of various traffic types, with multiple classes of service. This is different from the Time Division Multiplexing (TDM) format associated with the PSTN. In order to transmit the data additional equipment is added to the PSTN network such as ATM switches and ATM multiplexers providing ATM traffic management such as policing. The cost of providing ADSL solutions on a PSTN network is an expensive proposition and inhibits the ability of service providers to introduce new subscribers in a cost effective manner. Therefore, there is a need in the art for providing broadband services to new subscribers without the use of an expensive ATM infrastructure.

As operators begin introducing ADSL interfaces into the Access Network, the need for cost effective solutions which combine traditional narrowband services such as Plain Old Fashioned Telephone Service (POTS), Integrated Service Digital Network (ISDN) service, and narrowband data together with broadband services over ADSL becomes imperative. Solutions offered on ATM-based access platforms are often prohibitively expensive for access operators who have a small percentage of ADSL penetration together with their narrowband services. Such solutions may require ATM switching elements at all remote units, or Synchronous Digital Hierarchy/Synchronous Optical Network (SDH/SONET) transmission within the access network. What is needed is a low cost solution.

SUMMARY

The above mentioned problems with ADSL interfaces in Access Networks and other problems are addressed by embodiments of the present invention and will be understood by reading and studying the following specification. In one embodiment, a telecommunications network is provided. The telecommunications

network includes a plurality of remote units and a central unit coupled to the plurality of remote units over a TDM-based network. Each of the remote units include a time division multiplex bus. Asynchronous transfer mode traffic is directly mapped onto a plurality of time division multiplex lines.

In another embodiment, a telecommunications network is provided. The telecommunications network includes a plurality of remote units, a time division multiplex-based network coupled to the plurality of remote units and a central unit also coupled to the time division multiplex-based network. Each of the plurality of remote units includes a first time division multiplex bus. Asynchronous transfer mode traffic is directly mapped onto the first time division multiplex bus.

Additionally, a time division multiplex (TDM) remote unit is provided. The TDM remote unit includes a time division multiplex bus and a plurality of subscriber interface cards coupled to the time division multiplex bus. The plurality of subscriber interface cards comprise at least one asymmetric digital subscriber line interface card. The TDM remote unit also includes a time division multiplex matrix device and a transmission interface device each coupled to the time division multiplex bus.

An asymmetric digital subscriber line (ADSL) interface card is also provided. The ADSL interface card includes an asymmetric digital subscriber line (ADSL) interface device and a translation device coupled to the (ADSL) device. The ADSL interface card also includes an inverse multiplexer coupled to the asymmetric digital subscriber line interface device and a time division multiplex interface coupled to the inverse multiplexer.

Brief Description of the Drawings

Figure 1 is a block diagram of an illustrative embodiment of an access network that provides asymmetric digital subscriber line access for subscribers using a TDM infrastructure according to the teachings of the present invention.

Figure 2 is a block diagram of an illustrative embodiment of central unit within an access network that provides asymmetric digital subscriber line access for subscribers using a TDM infrastructure according to the teachings of the present invention.

Figures 3 is a block diagram that illustrates an embodiment of an asymmetric digital subscriber line card that interfaces with a TDM-based access network according to the teachings of the present invention.

DETAILED DESCRIPTION

In the following detailed description, reference is made to the accompanying drawings which form a part hereof, and in which is shown by way of illustration specific illustrative embodiments in which the invention may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention, and it is to be understood that other embodiments may be utilized and that logical, mechanical and electrical changes may be made without departing from the spirit and scope of the present invention. The following detailed description is, therefore, not to be taken in a limiting sense.

Figure 1 is a block diagram of an illustrative embodiment of an access network that provides asymmetric digital subscriber line access for subscribers using a TDM infrastructure, indicated generally at 100, according to the teachings of the present invention.

The access network 100 includes a central unit 120 coupled to a TDM-based network 150 and a plurality of remote units 140-1, … , 140-M also coupled to the TDM based network 150. Remote units 140-1, … , 140-M are each configured to receive at least one Asymmetric Digital Subscriber Line (ADSL), Plain Old Fashioned Telephone Service (POTS), Integrated Service Digital Network (ISDN) traffic from a plurality of subscribers. The ADSL, POTS, and ISDN traffic is received from a number of subscriber devices such as telephones, facsimile machines, personal computers (PCs), televisions, modems and the like. ADSL, POTS and ISDN traffic is also received by central unit 120 and routed through TDM-based network 150 for transmission by the remote units 140-1, … , 140-M to the plurality of subscribers and subscriber devices. Traffic includes any combination of analog or digital data from a variety of sources to include the telephone network, internet, cable television, modems, facsimile machines and the like. Access network 100 is a Digital Loop Carrier (DLC) system or platform which

directly maps ADSLs to TDM transmission lines in the remote unit then transmits ADSL, ISDN and POTS traffic to the Public Switched Telephone Network (PSTN), an Asynchronous Transfer Mode (ATM) switch, a Digital Subscriber Line Access Module (DSLAM) or other network which is capable of performing ATM processing.

TDM-based network 150 represents one or more of a TDM network, an SDH ring, a SONET ring or other appropriate network. The TDM-based network 150 is also coupled to central unit 120 for further transmission to the PSTN, ATM switch, DSLAM or other ATM processing network.

Remote units 140-1, ... , 140-M are each constructed in a similar manner. Thus for simplicity, only remote unit 140-1 is described in detail. Remote unit 140-1 includes subscriber interface cards 144-1-1, ... , 144-1-K, a TDM matrix or switching card 143-1 and a transmission interface device 141-1 which are all coupled to a time division multiplex bus 142-1. The interface cards 144-1 acts as an interface between the plurality of subscribers coupled to remote unit 140-1 and the TDM-based network 150. Remote unit 140-1 includes any combination of subscriber interface cards 144-1-1, ... , 144-1-K, e.g., analog and digital interface cards such as POTS interface cards, ISDN interface cards, ADSL interface cards and the like. The subscriber interface cards 144-1-1, ... , 144-1-K are coupled between the subscriber premises and a TDM transmission interface device 141 via the TDM bus 142. Each ADSL interface card in remote unit 144-1 directly maps ATM traffic from subscriber's ADSL lines onto TDM bus 142-1. Directly mapping the ATM traffic from the ADSL lines to TDM transmission lines does not include ATM processing such as ATM switching, assigning traffic descriptors for each connection, policing incoming traffic to insure that it meets its assigned or agreed to bandwidth requirements and the like.

In one embodiment, remote unit 140-1 includes ADSL interface cards, POTS interface cards and ISDN interface cards. In another embodiment, remote unit 140-1 includes a plurality of ADSL interface cards. In a further embodiment, remote unit 140-1 includes a plurality of ADSL interface cards, POTS interface cards and ISDN cards. In yet another embodiment, remote unit 140-1 includes POTS interface cards

and ISDN interface cards. It is understood that remote units 140-1, ... , 140-M include any number of subscriber interface cards 144-1, ... , 144-M in any appropriate combination.

In one embodiment, central unit 120 includes a plurality of TDM-based interface cards 121 and an ATM processing card with a single user-network interface (UNI) 128, a TDM matrix or switching card 122 and a transmission interface device 124 coupled to an internal TDM bus 126. Central unit 120 is coupled between TDM-based network 150 and the PSTN, an ATM switch, DSLAM or other network. ADSL data received at central unit 120 is routed by ATM processor and UNI card 128 to an ATM switch, DSLAM or network which is capable of performing ATM processing. The Central Unit 120 selectively transports ADSL, ISDN and POTS traffic from the TDM-based network 150 to the appropriate network via one of interface card 121, ... , 121-P and ATM processor and UNI card 128. The Central Unit 120 separates the traffic received from the remote units 140-1, ... , 140-M to be transmitted over appropriate interfaces cards 121, ..., 121-P, and ATM processor and UNI card 128 to central office switching equipment. For example, POTS and ISDN traffic may be switched within the central unit to digital switch interfaces such as V5.n. Central Unit 120 also selectively transports ADSL, POTS and ISDN traffic from the interface cards 121-1, ..., 121-P and ATM processor and UNI card 128 to TDM-based network 150.

ATM processor and UNI card 128 performs ATM processing to include ATM switching, assigning traffic descriptors for each connection, policing incoming traffic to insure that it meets its assigned or agreed to bandwidth requirements and the like. ATM processor and UNI card 128 then provides a single synchronous transport module 1 (STM-1) user-network interface (UNI) to the PSTN, an ATM switch, DSLAM or other network. The ATM processor and UNI card 128 concentrates all ATM traffic extracted from the E1s or T1s bearing ATM traffic from the remote units 140-1, ... , 140-M, and then processes them and forwards the ATM traffic to the PSTN, an ATM switch, DSLAM or other network via the single UNI. In the direction from the PSTN, an ATM switch, DSLAM or other network,

the single UNI receives ATM traffic, processes it, and forwards it to be mapped into E1s or T1s for transmission back towards the remote units 140-1, ... , 140-M.

Transmission interface device 141-1 located in remote units 140-1, ... , 140-M and the transmission interface device 124 located in central unit 120 include any one of an optical transmission interface device, a copper wire transmission interface device, an HDSL transmission interface device or the like.

In one embodiment, interface cards 121-1, ... , 121-P comprise E1 interface cards that link data from and to NxE1 transmission lines. E1 transmission lines are used outside of North America and Japan and supply 32 channels at 2.048 Mbps. T1 transmission lines are mainly used in North America and supply 24 channels at 1.544 Mbps. It is understood, when referring to E1, that T1 is also included.

In operation, access network 100 is configured to provide ADSL services in a TDM network without costly ATM equipment or the need for ATM processing. In the upstream direction, ADSL, ISDN and POTS traffic is generated by subscriber devices at subscribers premise, such as telephone, facsimile, personal computer, television. Subscriber interface cards 144-x-x of remote units 140-1, ... , 140-M receive the ADSL, ISDN and POTS traffic and directly map the data onto TDM transmission lines for transport to TDM-based network 150. ADSL, ISDN and POTS traffic is transported as TDM traffic. TDM-based network 150 receives ADSL, ISDN and POTS traffic from a number of remote units 140-1, ... , 140-M. TDM-based network 150 then transmits the ADSL, ISDN and POTS traffic as TDM traffic to a central unit 120. Central unit 120 receives the traffic and optionally transmits ATM traffic via a single ATM pipeline or user network interface after ATM processing by ATM processor and UNI card 128 or transmits the ATM traffic as TDM traffic via TDM lines e.g. E1s or T1s. The ADSL, ISDN and POTS traffic is transmitted to the PSTN, ATM switch, DSLAM or other appropriate ATM network for ATM processing, if required. Access Network 100 operates in a reverse manner in the downstream direction. Advantageously, ADSL services are integrated into a TDM network without an ATM infrastructure.

Figure 2 is a block diagram of an alternate embodiment of a central unit, indicated generally at 200, according to the teachings of the present invention.

Central unit 200 is coupled to an ATM multiplexer 295. Central unit 200 includes a plurality of interface cards 221.1, ... , 221.P without an ATM processor card 128 as included in central unit 120 of Figure 1. Central unit 200 includes a TDM matrix card 222 and a transmission interface device 224 coupled to a TDM bus 226. Transmission interface device 224 includes any one of an optical transmission interface device, a copper wire transmission interface device, an HDSL transmission interface device or the like.

Central unit 200 receives ADSL, ISDN and POTS traffic from a TDM-based network such as TDM-based network 150 described with respect to Figure 1. The ADSL, ISDN and POTS traffic is then transmitted by each interface card 221 onto a plurality of TDM transmission lines such as E1s or T1s to an external ATM multiplexer 295 which takes the E1s or T1s processes them for transmission to the PSTN, ATM switch, DSLAM or other appropriate network. The ADSL, ISDN and POTS traffic is transmitted via TDM interface cards 221.1, ... , 221.P at a TDM level without any ATM processing. Similarly ADSL, ISDN and POTS traffic is received by TDM interface cards 221.1, ... , 221.P via TDM transmission lines for further transmission to an TDM-based network and a plurality of remote units 140-1 to 140-M as discussed with respect to Figure 1.

In one embodiment, interface cards 221-1, ... , 221-P comprise E1 interface cards that link data from and to NxE1 transmission lines.

In operation, central unit 200 is functional in an access network 100 as described with respect to Figure 1. In the upstream direction, central unit 200 receives ADSL, ISDN and POTS traffic and transmits the traffic as TDM traffic via TDM lines e.g. E1s or T1s. The ADSL, ISDN and POTS traffic is transmitted to an external ATM multiplexer 295 which takes the E1s or T1s processes them for transmission to the PSTN, ATM switch, DSLAM or other appropriate network. In one embodiment the ATM multiplexer is an ADC Kentrox AAC Access Concentrator. Central unit 200 operates in a reverse manner in the downstream direction. Advantageously, ADSL services are available in a TDM network without an ATM infrastructure and without ATM processing.

Figure 3 is a block diagram that illustrates an embodiment of an Asymmetric Digital Subscriber Line Interface Card, indicated generally at 300, according to the teachings of the present invention. ADSL interface card 300 directly maps ATM traffic from subscriber's ADSL lines onto TDM lines, e.g. T1 or E1 lines, without performing ATM processing. ADSL interface card 300 includes a splitter 301 coupled to an ADSL interface device 304 and a POTS circuit 303. Data received on ADSL lines from subscribers is separated by splitter 301 into ATM data and POTS data. POTS data is transmitted to the POTS circuit 303 and then to the TDM interface 310 where it is joined with the ATM data to be transmitted as TDM traffic. The ATM data is received by the ADSL interface device 304 and based on the amount and type of ATM data (e.g. high, low, medium bandwidth) it is determined whether or not a translation header is required to transport the data. Data requiring a translation header is transmitted to the translation device 306 for assignment.

ADSL interface card 300 operates in low, medium and high bandwidth modes. In the low bandwidth mode, low bandwidth ATM data (e.g., ADSL services for the internet where a few hundred kilobits are required) is received by the ADSL interface device 304 from a plurality of ADSLs and transmitted to translation device 306 for header translation processing. The header translation process includes looking at the virtual path identifier (VPI) and combining the VPI with a port number. The port number corresponds to a respective ADSL port where the data is received. The ATM data is then directly mapped onto a single transmission line, e.g. E1 or T1 line by inverse multiplexer/TDM physical interface device 308 and transmitted to the TDM interface 310. The data is then transmitted to a TDM bus for further transmission to a TDM-based network. Inverse multiplexer/TDM physical interface device 308 performs ATM inverse multiplexing and ATM TDM physical interface and will be referred to in this application as an inverse multiplexer.

In the moderate bandwidth mode, moderate bandwidth ATM data (e.g., ADSL services requiring less than approximately 1.544 Mbps for T1 and less than approximately 2.048 for E1) is received by ADSL interface device 304 from a plurality of ADSLs and transmitted to inverse multiplexer 308. The ATM data is

then directly mapped onto a plurality of TDM transmission lines, e.g. T1 or E1, on a one to one basis. For example 3 moderate ADSLs are directly mapped onto 3 E1 or T1 lines. ADSL card 300 can accommodate up to 4 ADSLs to be directly mapped onto 4 E1 or T1 lines. The ATM data is then transmitted to TDM interface 310 via the E1 or T1transmission lines for further transmission to an access network.

In a high bandwidth mode, high bandwidth ATM data (i.e. video) is received by ADSL interface device 304 from a plurality of ADSLs and transmitted to inverse multiplexer 308. The ATM data is then directly mapped onto a plurality of E1 or T1 transmission lines where up to four E1s or T1s operate as a single high bandwidth pipe. Inverse multiplexer 308 allows the E1s or T1s to be shared as a single pipe with approximately 8 Mbps of bandwidth. The ATM data is then transmitted to TDM interface 310 via the E1 or T1 transmission lines for further transmission to an access network.

ADSL interface card 300 also operates in reverse where it receives low, moderate and high bandwidth data from a TDM-based network on TDM transmission lines and transmits the data to subscribers via ADSLs. The data is received at TDM interface 310 from a TDM bus. The data is split into ATM and POTS traffic. POTS traffic is transmitted to POTS circuit 303 and then to splitter 301 for transmission to subscribers. ATM traffic is transmitted to inverse multiplexer 308 and directly mapped onto ADSLs for transmission to subscribers. ATM data directly mapped onto ADSLs is transmitted to ADSL interface device 304 and to splitter 301 for transmission to designated subscribers.

Conclusion

Although specific embodiments have been illustrated and described in this specification, it will be appreciated by those of ordinary skill in the art that any arrangement that is calculated to achieve the same purpose may be substituted for the specific embodiment shown. This application is intended to cover any adaptations or variations of the present invention. For example, the integrated ADSL interface card in one embodiment is part of a digital loop carrier. In further embodiments, the integrated ADSL interface card is located card is located in a central office. It is understood that the integrated ADSL interface card can be

implemented with any appropriate combination of services whether conventional or later developed. Additionally, the central unit in one embodiment maps ATM traffic onto a single UNI and in another embodiment the central unit maps ATM traffic onto TDM lines. It is understood that the central unit can be implemented to map ATM, POTS, ISDN and other digital or analog traffic onto one or more transmission lines, e.g. E1s, T1s, STM-1, etc., whether conventional or later developed.

What is claimed is

1. A telecommunications access network, comprising:

a plurality of remote units, wherein each of the plurality of remote units includes a first time division multiplex bus;

a time division multiplex-based network coupled to the plurality of remote units;

a central unit coupled to the time division multiplex-based network; and

wherein asynchronous transfer mode traffic is directly mapped onto the first time division multiplex bus.

2. The telecommunications network of claim 1, wherein the plurality of remote units comprises:

a plurality of subscriber interface cards coupled to the first time division multiplex bus; and

a transmission interface device coupled to the first time division multiplex bus.

3. The telecommunications access network of claim 2, wherein the plurality of interface cards includes at least one asymmetric digital subscriber line interface card which directly maps the asynchronous transfer mode traffic onto the first time division multiplex bus.

4. The telecommunications access network of claim 3, wherein the asymmetric digital subscriber line interface card comprises an inverse multiplexer.

5. The telecommunications access network of claim 1, wherein the central unit includes:

a second time division multiplex bus; and

a plurality of interface cards coupled to the second time division multiplex bus.

6. The telecommunications network of claim 5, wherein the plurality of interface
cards comprise a plurality of time division multiplex interface cards.

7. The telecommunications network of claim 6, further comprising an asynchronous transfer mode multiplexer coupled to the central unit.

8. The telecommunications network of claim 5, wherein one of the plurality of time division multiplex interface cards comprises an asynchronous transfer mode processor and a user network interface.

9. A telecommunications network comprising:
a remote unit, comprising:
a plurality of subscriber interface cards;
a first time division multiplex bus coupled to the plurality of interface cards;
a time division multiplex switching device coupled to the first time division multiplex bus;
a transmission interface device coupled to the first time division multiplex bus; and
wherein the remote unit directly maps asynchronous transfer mode traffic onto a plurality of time division multiplex lines;
a time division multiplex based-network; and
at least one central unit coupled to the time division multiplex based-network.

10. The telecommunications network of claim 9, wherein the plurality of subscriber interface cards include at least one asymmetric digital subscriber line interface card.

11. The telecommunications network of claim 9, wherein the central unit includes:

a second time division multiplex bus; and

a plurality of interface cards coupled to the second time division multiplex bus.

12. The telecommunications network of claim 11, wherein the plurality of interface cards comprise a plurality of time division multiplex interface cards.

13. The telecommunications network of claim 11, wherein one of the plurality of interface cards comprise an asynchronous transfer mode processor and a user network interface.

14. The telecommunications network of claim 12, further comprising an asynchronous transfer mode multiplexer coupled to the central unit.

15. A telecommunications network, comprising:

a plurality of remote units, wherein each of the plurality of remote units includes a time division multiplex bus;

a central unit coupled to the plurality of remote units; and

wherein asynchronous transfer mode traffic is directly mapped onto a plurality of time division multiplex lines.

16. The telecommunications network of claim 15, wherein each of the plurality of remote units includes:

a plurality of subscriber interface cards coupled to the time division multiplex bus; and

a transmission interface device coupled to the time division multiplex bus.

17. The telecommunications network of claim 16, wherein the plurality of interface cards comprise an asymmetric digital subscriber line interface card which directly maps the asynchronous transfer mode traffic onto the plurality of time division multiplex lines.

18. The telecommunications network of claim 15, wherein the central unit includes:

a time division multiplex bus; and

a plurality of interface cards coupled to the time division multiplex bus.

19. The telecommunications network of claim 18, wherein the plurality of interface cards comprises a plurality of time division multiplex cards.

20. The telecommunications network of claim 18, wherein one of the plurality of interface cards comprise an asynchronous transfer mode processor and user network interface.

21. The telecommunications network of claim 19, further comprising an asynchronous transfer mode multiplexer coupled to the central unit.

22. A time division multiplex remote unit, comprising:

a time division multiplex bus;

a plurality of subscriber interface cards coupled to the time division multiplex bus;

a time division multiplex matrix device coupled to the time division multiplex bus;

a transmission interface device coupled to the time division multiplex bus; and

wherein the plurality of subscriber interface cards comprise at least one asymmetric digital subscriber line interface card.

23. The remote unit of claim 22, wherein the transmission interface device is an optical transmission interface device.

24. The remote unit of claim 22, wherein the transmission interface is a high bit rate digital subscriber line interface device.

25. An asymmetric digital subscriber line interface card, comprising:

an asymmetric digital subscriber line interface device;

a translation device coupled to the asymmetric digital subscriber line interface device;

an inverse multiplexer coupled to the asymmetric digital subscriber line interface device that directly maps asynchronous transfer mode directly to time division multiplex; and

a time division multiplex interface coupled to the inverse multiplexer.

26. An asymmetric digital subscriber line interface card, comprising:

a splitter;

an asymmetric digital subscriber line interface device coupled to the splitter;

a plain old fashioned telephone service (POTS) line termination circuit coupled to the splitter;

a translation device coupled to the asymmetric digital subscriber line interface device;

an inverse multiplexer coupled to the asymmetric digital subscriber line interface device that directly maps asynchronous transfer mode to time division multiplex; and

a time division multiplex interface coupled to the inverse multiplexer.

27. A method of transferring digital data, the method comprising:

receiving analog and digital data;

separating the digital data from the analog data;

preparing the digital data for transmission; and

directly mapping the digital data onto a time division multiplex transmission line.

28. The method of claim 27, wherein preparing the digital data for transmission comprises combining a virtual path identifier for the digital data with a port number.

29. A method of transporting asynchronous transfer mode (ATM) data on a digital loop carrier platform, the method comprising:

receiving asynchronous transfer mode (ATM) traffic and plain old fashioned telephone service (POTS) traffic;

separating the ATM traffic from the POTS traffic;

transporting the POTS traffic to a time division multiplex bus;

determining if a translation header is required for the ATM traffic;

when a translation header is required, assigning a translation header to the ATM traffic;

directly mapping the ATM traffic to at least one time division multiplex transmission line;

transporting the ATM traffic to the time division multiplex bus; and

transmitting the ATM traffic with the POTS traffic to an access network.

30. A method of transporting low bandwidth asynchronous transfer mode data on a digital loop carrier platform, the method comprising:

receiving asynchronous transfer mode (ATM) traffic and plain old fashioned telephone service (POTS) traffic from a plurality of asymmetric digital subscriber lines;

separating the ATM traffic from the POTS traffic;

transporting the POTS traffic to a time division multiplex bus;

assigning a translation header to the ATM traffic;

directly mapping the ATM traffic to one time division multiplex transmission line;

transporting the ATM traffic to the time division multiplex bus; and

transmitting the ATM traffic with POTS traffic to an access network.

31. A method of transporting asynchronous transfer mode data on a digital loop carrier platform, the method comprising:

receiving asynchronous transfer mode (ATM) traffic and plain old fashioned telephone service (POTS) traffic from a plurality of asymmetric digital subscriber lines;

separating the ATM traffic from the POTS traffic;

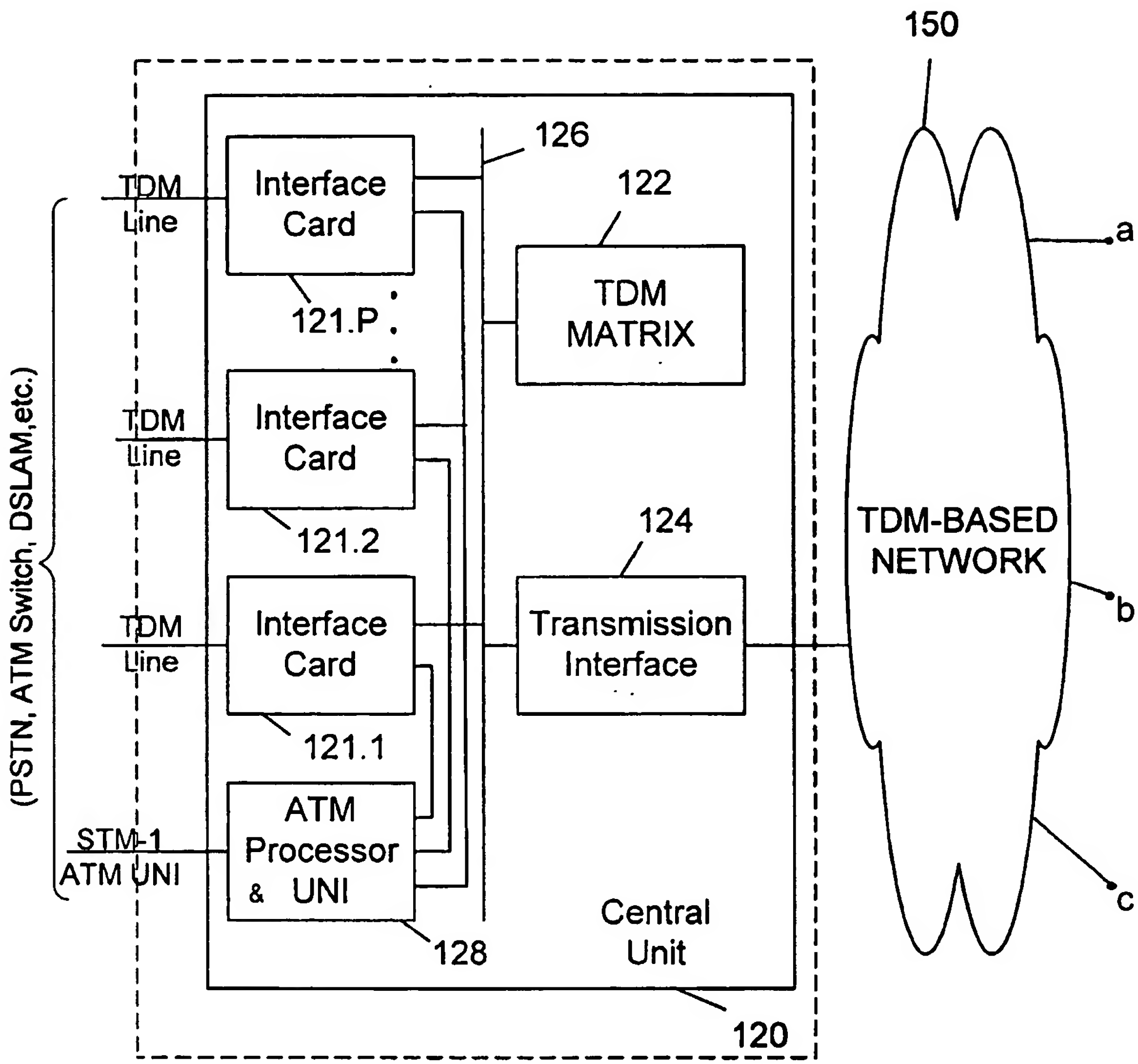
transporting the POTS traffic to a time division multiplex bus;

directly mapping the ATM traffic to a plurality of time division multiplex transmission lines;

transporting the ATM traffic to the time division multiplex bus; and

transmitting the ATM traffic with POTS traffic to an access network.

32. The method of claim 31, wherein receiving ATM and POTS traffic from a plurality of asymmetric digital subscriber lines comprises receiving ATM and POTS traffic from four asymmetric digital subscriber lines and wherein directly mapping the ATM traffic to a plurality of time division multiplex transmission lines comprises directly mapping the ATM traffic to four time division multiplex transmission lines.


150
126
122
Interface Card
TDM Line
121.P
TDM MATRIX
a
Interface Card
TDM Line
121.2
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TDM-BASED NETWORK
(PSTN, ATM Switch, DSLAM,etc.)
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Transmission Interface
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Central Unit
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c
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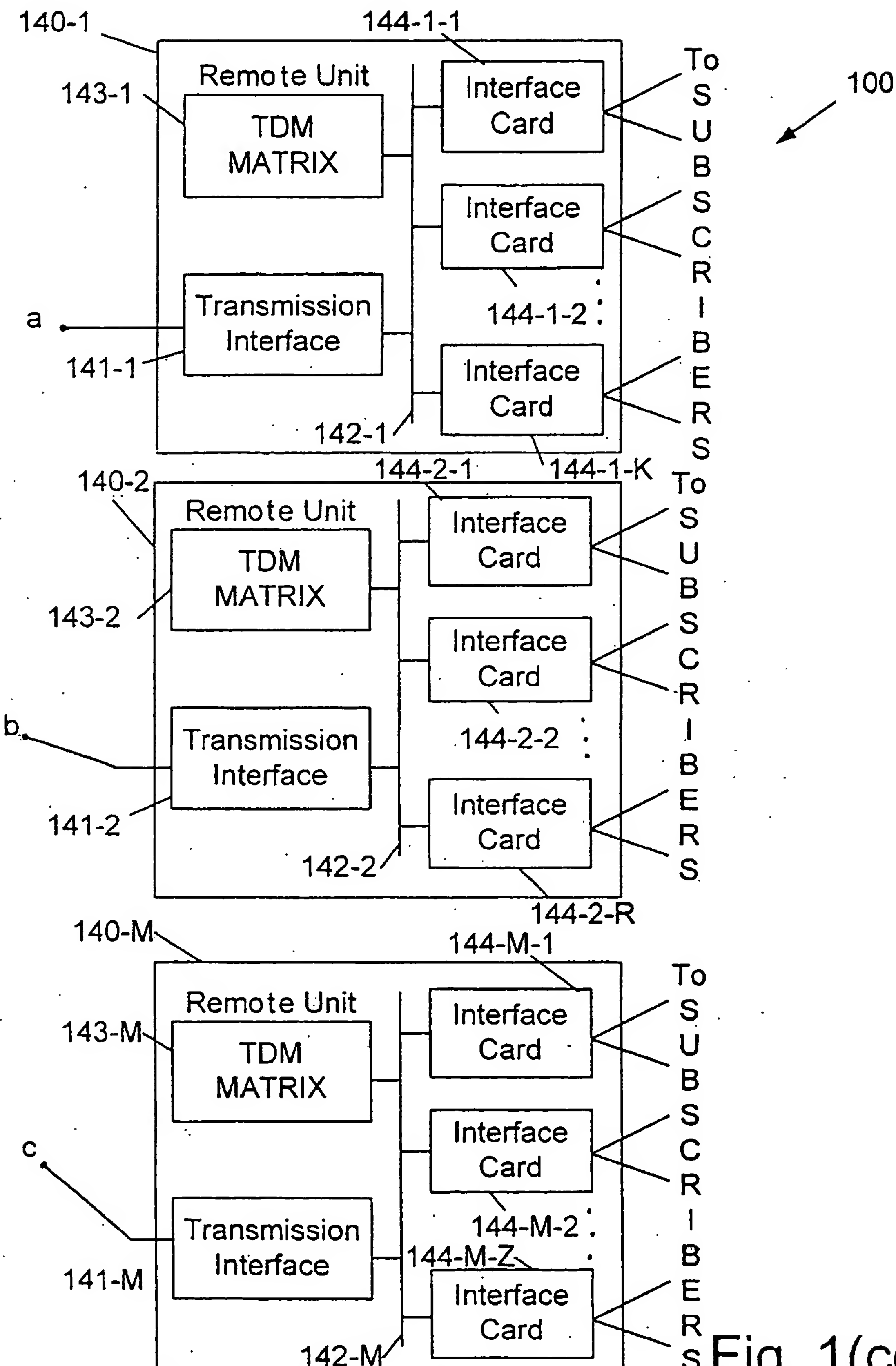
Fig. 1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140-2
144-2-1
Remote Unit
TDM MATRIX
143-2
Interface Card
Interface Card
b
Transmission Interface
144-2-2
141-2
Interface Card
142-2
144-2-R
To SUBSCRIBERS
140-M
144-M-1
Remote Unit
143-M
TDM MATRIX
Interface Card
Interface Card
c
Transmission Interface
144-M-2
144-M-Z
141-M
Interface Card
142-M
To SUBSCRIBERS

Fig. 1(cont.)

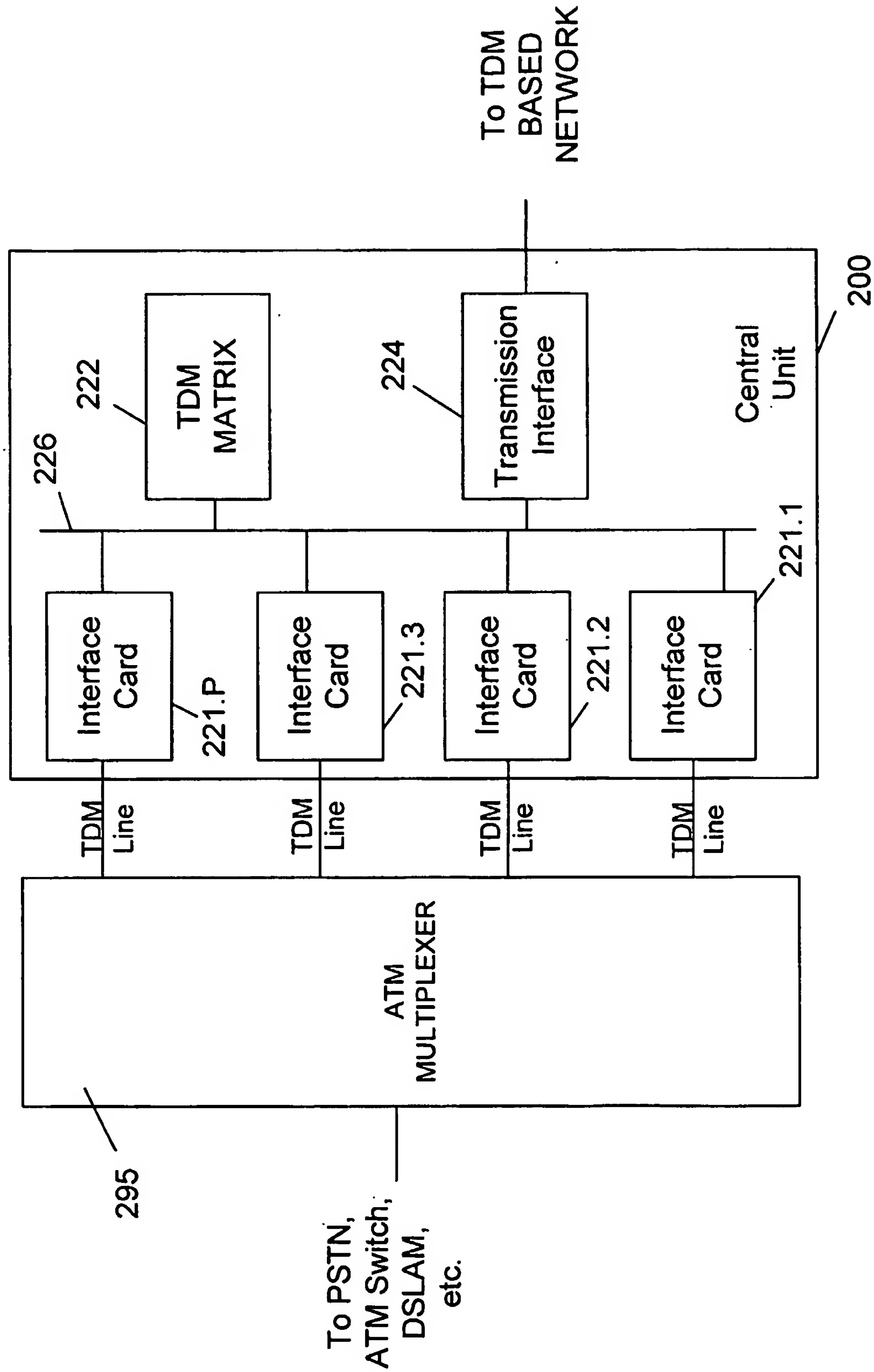
To TDM BASED NETWORK
TDM MATRIX
222
226
224
Transmission Interface
Central Unit
200
Interface Card
221.P
221.3
221.2
221.1
TDM Line
ATM MULTIPLEXER
295
To PSTN, ATM Switch, DSLAM, etc.

Fig. 2

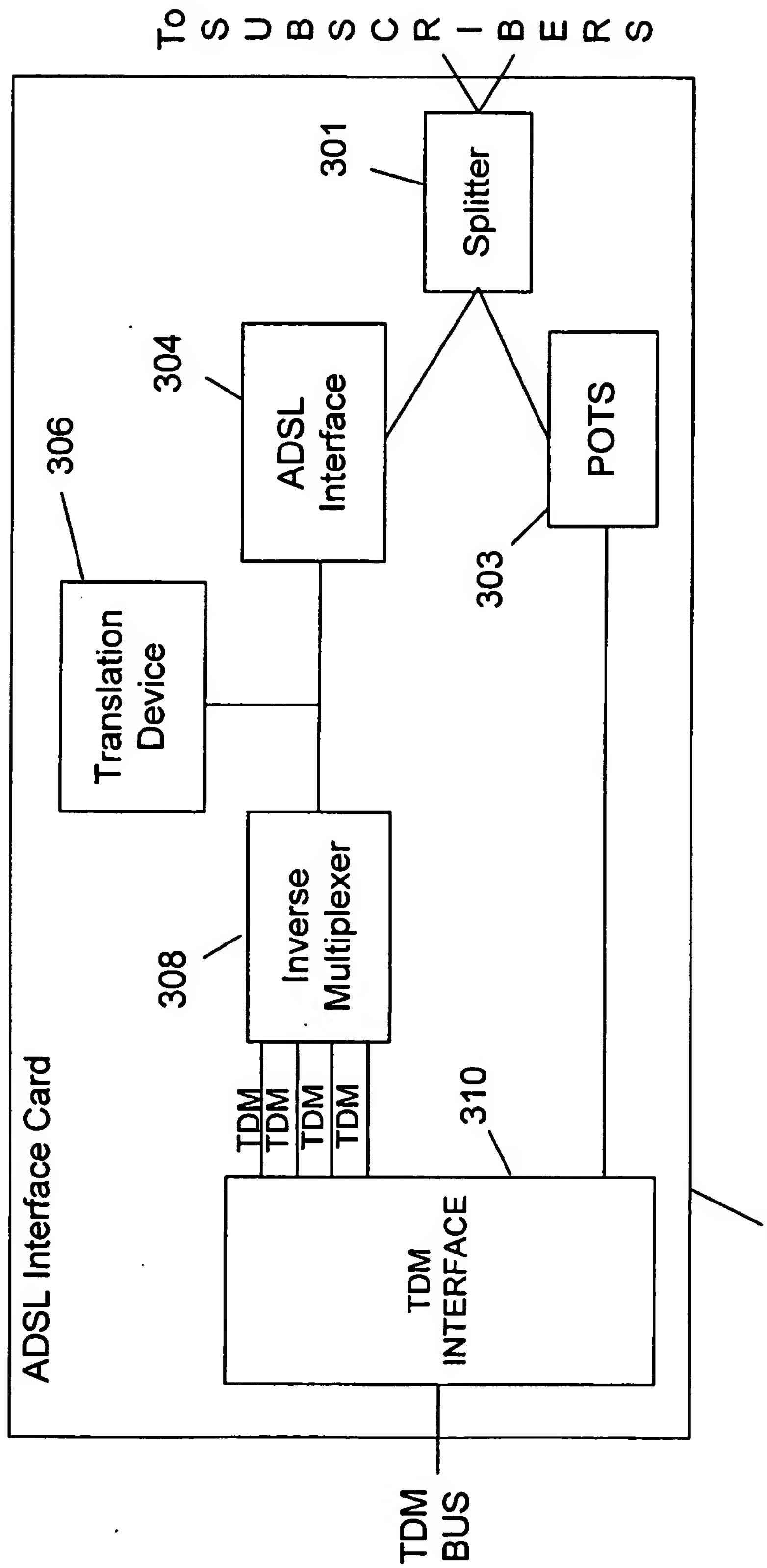
To SUBSCRIBERS
Splitter
301
ADSL Interface
304
POTS
303
Translation Device
306
Inverse Multiplexer
308
TDM
TDM
TDM
TDM
310
TDM INTERFACE
ADSL Interface Card
300
TDM BUS

Fig. 3

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